

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
25 March 2004 (25.03.2004)

PCT

(10) International Publication Number  
**WO 2004/024316 A1**

(51) International Patent Classification<sup>7</sup>: **B01J 19/08**

(21) International Application Number:  
PCT/US2003/027645

(22) International Filing Date:  
4 September 2003 (04.09.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/409,805 10 September 2002 (10.09.2002) US

(71) Applicant (for all designated States except US): **WIS-  
CONSIN ALUMNI RESEARCH FOUNDATION**  
[US/US]; 614 Walnut Street, Madison, WI 54707-7365  
(US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **DENES, Ferencz,**

S. [US/US]; 485 Togstad Glen, Madison, WI 53711 (US).  
**MANOLACHE, Sorin, O.** [RO/US]; 602 Eagle Heights,  
Madison, WI 53705 (US).

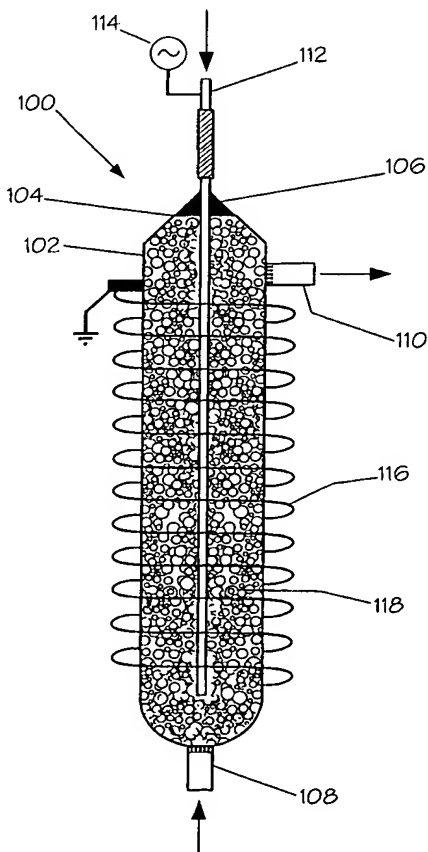
(74) Agents: **FIESCHKO, Craig, A.** et al.; DeWitt Ross &  
Stevens S.C., 8000 Excelsior Drive, Madison, WI 53717-  
1914 (US).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,  
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,  
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,  
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,  
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,  
MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC,  
SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA,  
UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),  
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),

[Continued on next page]

(54) Title: PLASMA TREATMENT WITHIN DIELECTRIC FLUIDS



(57) Abstract: A dielectric liquid having entrained bubbles of gas or vapor is subjected to an electric field applied between spaced electrodes (112, 116) which generates microdischarges (and thus plasma) within the bubbles, allowing modification of the properties of the dielectric liquid. The invention is particularly useful for treating hydrocarbon liquids such as gasolines and other liquid hydrocarbon fuels, which have extremely low dielectric constants. Generating microdischarges within bubbles in such fuels can create compounds useful for higher combustion efficiency and/or lower emissions in internal combustion engines. The invention may be directly implemented in an engine's fuel line upstream from the combustion chamber (e.g., immediately prior to a fuel injector), thereby allowing the invention to be usefully implemented for fuel treatment prior to combustion.

WO 2004/024316 A1